

theoretically solved. On February 14, 1876, Gray registered this invention at the American Patent Office, under the title of "a means of transmitting and receiving vocal sounds telegraphically," and in his caveat he gives an exact drawing of the method he adopts, and which we here reproduce.

Curiously enough, on the very same day, there appears the first documentary evidence on behalf of Prof. Graham Bell, and this, too, is for a patent granted to Bell—not, however, for the electric transmission of speech, but "for certain new and useful improvements in telegraphy." These improvements consist in the employment of *induced* undulatory electric currents, and form one of the numerous practical applications of Faraday's famous discovery of magneto-electric induction. By the approach and recession of the prongs of a magnetised tuning-fork, or by the oscillation of a magnetic diaphragm, alternating currents were generated in an adjacent coil of wire. This is the essence of Bell's patent, the advantages claimed by the use of such undulatory currents being increased speed of telegraphy and the possibility of multiplex telegraphy. Nothing is said about the transmission of speech till near the end of the specification, when it is stated that "one of the ways in which the armature may be set in motion [to generate these currents] is the wind. Another mode is the human voice, or by means of a musical instrument." So that, of the five claims made by this patent, the last, and apparently quite subsidiary one, was "the method of transmitting vocal or other sounds telegraphically." A diagram of the arrangement devised for this purpose accompanies the specification, which arrangement, however, upon subsequent trial, proved, as Prof. Bell stated in London, "unsatisfactory and discouraging." It is not, however, fair to conclude, as Mr. Prescott has done in the words we quoted earlier, that Bell had to resort to Gray's method before he was enabled to transmit speech electrically. The fact seems to be that some little time after he obtained his patent, Bell turned his attention to the development of the speaking telephone, and by a modification of the method he originally proposed, arrived at some important results which were published on May 10, 1876, in the *Proceedings of the American Academy of Arts and Sciences*. Sir W. Thomson heard articulate sounds transmitted by this telephone in August, 1876, but the instrument was then very imperfect, nor was it until the early part of 1877 that the speaking telephone may be said to have been a *fait accompli*; in May, 1877, it was successfully tried between Providence and Boston, places forty-three miles apart. There seems reason to believe that the important improvement of the substitution of permanent magnets for electro-magnets was made at the suggestion of Prof. Dolbear, and that Professors Peirce, Blake, Channing, and others contributed valuable modifications of the original design, until the Bell telephone assumed its present simple, elegant, and handy shape, growing in efficiency as it diminished in size and complexity.

Thus it will be seen both Gray and Bell can fairly claim the discovery of the principle of the articulating electric telephone. Gray solved the problem first theoretically, Bell first practically; the former proposed to vary the resistance of the circuit without changing the electromotive force; the latter varied the electromotive force without changing the resistance. And although Gray's method was only partially successful in operation, owing to his employing an electrolytic resistance, it is a method capable of yielding more striking results, owing to the use of more powerful currents. But where Gray failed, Edison has succeeded, and in another article we propose to trace the connection of this remarkable inventor with the subject of electric-telephony, up to his splendid discovery of the carbon telephone.

W. F. BARRETT

COLOUR BLINDNESS IN RELATION TO THE HOMERIC EXPRESSIONS FOR COLOUR¹

II.

SO far as I can follow Mr. Gladstone's investigations, it appears to me that Homer has exactly fulfilled all the conditions mentioned in the previous article. As many references are made to natural objects which have the same colours now as they had in his time, I am able, with my colour-blind experience, to judge what sensations they would present to his eyes, supposing him colour-blind, and I can thus form a judgment of the appropriateness and consistency of his descriptions on that hypothesis. I can clearly trace the existence of two groups of epithets, which, so far as I can see, are kept fairly distinct, and the words in which are never mixed up with the ideas belonging to the contrary group. The epithets are—

For the group of the yellow sensation: ξανθός, ἐρυθρός, φοῖνιξ, ῥοδόεις, χλωρός, κυάνεος, and perhaps οἰνοψ.

For the group of the blue sensation: πορφύρεος and ἰοειδής.

For neutral sensations, irrespective of the words λευκός and μέλας (which may be left out of consideration altogether, the use of them being normal, and the vision of the colour-blind in regard to them being normal also) there is the epithet πολίος, on which an important element of the argument hangs.

We will now take these various words *seriatim*, and compare what Mr. Gladstone says of their application with the use that might be expected to be made of them by a colour-blind writer.

Ξανθός.

Liddell and Scott's translation of this word is "yellow of various shades, often with a tinge of red, chestnut, auburn." Mr. Gladstone (N. 380) considers it, as used by Homer, to be a true word of colour, and that its applications are especially consistent.

It is used principally for human hair, and to the colour-blind *all* varieties of hair, except such as is positively jet-black, appear shades of yellow. Fair or golden hair is a light yellow, red and auburn hair are deeper tones, more intensely coloured, and all varieties of brown are darker still.

The word is also used for the colour of horses. All the varieties of chestnut and bay are to the colour-blind dark yellow, a yellow brown, the former of a lighter, the latter of a darker shade.

Ἐρυθρός.

This is, I suppose, the most usual Greek word for red.

Mr. Gladstone (N. 375) takes it to be the best approach to a true genuine colour-epithet, but at the same time he remarks how strange it is that Homer's idea even of red does not seem to be wholly distinct.

The difficulty, however, vanishes if we suppose Homer to have been in the position of the colour-blind, to whom, as I have explained, the proper idea of red is unknown. The word, according to Mr. Gladstone (N. 375, H. 460), is applied to copper, nectar, wine, and blood, all which, though they may differ in appearance to the normal-eyed, present to the colour-blind only different modifications of the yellow sensation.

In regard to blood, the hue varies according to its condition, arterial blood differing materially from venous blood in its colour. I believe that normal-eyed people hesitate to recognise any yellow element in it in any condition, but it is quite certain that when bright and freshly-oxygenated, it presents a sensation of yellow to me; and this is consistent with the fact that its colour is said to be chiefly due to the oxygenation of the iron it contains, the peroxide of iron being to me very positively yellow.

I conceive it may be possible that in this, as in many

¹ Continued from p. 679.

other cases of red, the yellow element may really be there, but may be so overpowered, to the normal eye, by the more vivid red sensation as to be undistinguishable to them, whereas to me, who am free from such interference, it is distinctly visible.

When blood is in the venous state it alters its colour, losing the yellow and acquiring the blue; and I believe normal-eyed people admit the existence of the blue element in blood of this kind. This fact will be found of importance in a subsequent place.

Mr. Gladstone adds:—"The favourite use of the word is for wine; this is very remarkable, because wine is not of a redness proper, but only approximative, and with a decided infusion of the idea of darkness." He also notices its application to the dark hue of red sandstone rock, and sums up by saying that the word is, in the great majority of instances, associated with dark rather than with bright. This is quite in accordance with the darkening idea of red that pervades the colour-blind theory.

Φοινίξ.

This word is translated by Liddell and Scott, "a purple red, purple, or crimson." It is used very frequently by Homer, and Mr. Gladstone (N. 372, H. 463) finds many difficulties from its being applied to colours materially different from each other. If, however, we test his examples by the dichromic perceptions, we shall find all the difficulties disappear.

The first application is to blood; and in this case the word would appear to be synonymous with *eruthros*, and is justifiable on either the normal or the colour-blind principle.

But it is also applied to the colour of a horse, who was *phoinix* all over except a white spot on his forehead. Mr. Gladstone says that the same epithet sits very ill upon blood and the colour of a horse, whether bay or chestnut; and no doubt this is true as far as normal-eyed people are concerned, inasmuch as the equine hues contain, I am told, a much larger amount of yellow, being, in accurate colour terms, different varieties of orange-brown. But to the colour-blind these present only their yellow element, and since it is by that same element that arterial blood is recognised, there is no incongruity in the person describing both by the same term. It is curious that, whereas in the case of blood *phoinix* is used as a synonym for *eruthros*, in the case of horses it is used as a synonym for *xanthos*—a strong presumption in favour of the *grouping* I have insisted on—the combination being justified through the common element of yellow.

Phoinix is also used for the back of a dragon or serpent, for jackals, and for the skin of a lion. The lion is, even to normal-eyed people, exactly my colour, yellow brown, and the jackal, though grey or variegated on the back, has much of the same hue about him. I never saw a dragon; but snakes vary much in colour, and at least half the varieties at the Zoological Gardens convey to me a positive impression of yellow.

A compound of the word is also applied indirectly, by a comparison with the serpent (H. 476) to the rainbow. For the explanation of this, see the word *porphureos* farther on. It is also applied to cloaks or mantles, which Mr. Gladstone concludes were not red, as Homer never applies to them the more positive epithet for that colour. As we do not know what hue they were, we cannot reason on this application: it is sufficient for my purpose to assume they may have been some of the many varieties of colour which would give the yellow sensation to the colour blind.

It is applied to the bows of ships, which are known to have been painted with some kind of red colour.

If the word *phoinix*, used in *Od.* vi. 163 to mean the palm tree, has any connection with the colour epithet, as Mr. Gladstone appears to suggest, it furnishes a startling addition to the proof of the colour-blind theory.

The confusion of red and green is incomprehensible to the normal-eyed, but it is one of the best-marked symptoms of the dichromic malady. *Phoinix* to me would just as correctly represent the leaves of a palm as it would arterial blood, a chestnut horse, or the skin of a lion.

It is clear, therefore, that we have only to suppose *phoinix* to be one of a group of words, all representing the colour-blind sensation of yellow in some of its varied shades and tones, and the whole of these apparently strange and anomalous applications become natural and justifiable. Indeed, Mr. Gladstone (H. 455) notices the analogy with *xanthos*, and remarks that *phoinix* appears merely to "render other words."

Ῥόδæος.

Referring to the rose; rosy. In noticing the use of this word, Mr. Gladstone (N. 376) at once seizes on the remarkable fact that, although the redness of the rose is so obvious, yet "there is no direct point of contact between Homer's expressions taken from the rose, and *eruthros*, as they are never applied to the same objects."

But this is perfectly in accordance with the sensations of the colour-blind. It was pointed out long ago by Dalton, and I took some trouble to explain the fact scientifically in my paper, that "Crimson and pink (rose colour) appear to have no relation to the idea of red derived from vermilion or a soldier's coat;" and if the colour-blind person has been in the habit of using *eruthros* for the latter it would do violence to his sense of colour to use it also for the rose. This flower, beautiful and positive as its colour is to the world in general, gives to me a very vague impression. Its characteristic of redness being invisible to us, we see in most cases only a pale grey; if the colour inclines to scarlet this will be tinged with yellow; if very crimson it will be tinged with blue.

Mr. Gladstone (N. 376, H. 469) is naturally puzzled by the application of the epithet rosy to olive oil, but the above explanation disposes of the difficulty. I have certainly heard my friends describe as "rosy" objects which to my eye would fairly match the pale yellow of oil.

Κυάνεος.

This is a word the explanation of which appears to be involved in much difficulty. It is said to mean the colour of a substance called *kuanos*, but what this substance was, or even what its colour was, appears open to much doubt.

The usual translation of the adjective, according to Liddell and Scott, is "dark blue" (whence the chemical term *cyanogen*), and there is no doubt that, in later Greek, it acquired significations positively identified with this colour. Mr. Gladstone, in 1858 (H. 496), discussed the meaning of *kuanos* at much length, and thought it most probably referred to a native blue carbonate of copper, an interpretation in accordance with its subsequent use and description as a colour. If, therefore, this meaning were adopted, the word *kuanos*, conveying a distinct idea of blue, could not be included in the same group with *xanthos*, *eruthros*, and *phoinix*, which all, as we have seen, belong to the opposite sensation.

But Mr. Gladstone, after reconsideration, appears, in his later article (N. 378, &c.), to have altered his view. He now considers it "almost certain that *kuanos* is bronze," and *kuanos*, either "made of, or in hue like bronze." This implies the abandonment of the idea of blue as connected with the adjective; for, so far as I know, there is not a vestige of the blue element in the colour of any combination of copper and tin. In any case, however, there is no doubt that a very dark hue is referred to.

Now the impression conveyed by bronze to the colour-blind eye is very dark, almost black, but with a tinge of dark yellow-brown; and keeping this in mind, if we

review the various applications of the word given by Mr. Gladstone (N. 378, H. 462), we shall find nothing inconsistent with this explanation. It is applied—

To eyebrows, to hair, and to the coat of a horse, in any of which cases a very dark brown may be shown.

To a dark cloud, which may be of the same hue.

To the serried mass of the Greek and Trojan armies. "The colour of these," says Mr. Gladstone, "must have been derived from their arms, and these would probably be composed in the main of two elements, firstly copper, which is ruddy, and secondly, the hides of oxen upon the shields and elsewhere." He notes that to a normal eye the colours of these are not easy to combine in a common idea:—but to the colour-blind the combination is homogeneous enough; they both look dark yellow-brown, and the appearance is quite in accordance with the interpretation of the word *kuaneos* according to Mr. Gladstone's later view. When in 1858 he appeared generally to favour the blue interpretation he remarked justly that it could not hold in this instance.

To a very black mourning garment. But the blackest dyes have almost always some leaning either to brown or blue, and the use of another word instead of *melas* might possibly imply this leaning, without diminishing the intensity of the shade.

To the sea-sand, just left bare by the water, also yellow-brown. Here again the idea of blue seems inapplicable.

To Amphitrite, or the sea beating on rocks. The *deep* sea is dark blue or dark green; but its appearance close to the shore in shallow places may be so indefinite, that no positive inference can be drawn from this use of the term.

To the prow of a ship; this, we know by other passages, was painted with red earth or ochre, and if dark would appear the colour here implied.

We have here exhausted Mr. Gladstone's list of instances where this difficult word is used clearly as a colour-epithet. They are all perfectly consistent on the colour-blind hypothesis, clearly pointing to the classification of *kuaneos* in the yellow group; for, so far as I can judge, there is not a single instance where its application necessarily implies the idea of blue.

Mr. Gladstone remarks (H. 465):—

"The uses of this group of words (*i.e.*, the group formed from *kuanos*) thus appear to exhibit a degree of indefiniteness hardly reconcileable with the supposition that Homer possessed accurate ideas of colour; there is no one colour that can cover them all." This is true; but only suppose him dichromically colour-blind, and the dark yellow-brown hue he may call *kuaneos* will cover every example where he has used the term.

Χλωρός.

I suppose no doubt is entertained that this word, derived from *chloē* (young herbage), means, and always has meant, green, one of the most plentiful colours in nature, and one of the most positive and distinct to persons with ordinary eyes.

Now Homer's use of the word affords one of the strongest arguments as to the identity of his sensations with those of the colour-blind. Let us see the testimony which Mr. Gladstone offers to this fact. After quoting (H. 467) the application of the word to a pale face, to fresh-pulled twigs, to honey, to an olive-wood club, and to the nightingale, he remarks:—

"Upon the whole, then, *chlōros* indicates rather the absence than the presence of definite colour. If regarded as an epithet of colour it involves at once a hopeless contradiction between the colour of honey on the one side and greenness on the other. Again, the more we assume it to mean green the more startling it becomes that it could have taken paleness, as is manifestly the case, for its governing idea. . . . The idea of green we scarcely find, unless once, connected with this word in the poems of Homer; and yet it is a remarkable fact that there is no other word in the poems that can even be supposed to repre-

sent a colour, which not the rainbow only, but every-day nature, presents so largely to the eye."

Again, in the later article Mr. Gladstone says (N. 380; the italics are mine):—

"It is plain, from the applications of it, that green was not on the list of Homer's colours. If I am to choose an English equivalent for the phrase it will be pale; and pale is not properly an epithet of colour so much as of light, although *there may perhaps be detected in it a very faint inkling*, so to speak, of yellow. If we strive to give the sense of colour we find there is none that will cover them in common, *yellow suiting in some cases*, green in others, neither of the two in all."

Speaking further of the application of *chlōreïs* to the nightingale, he adds:—

"The balance of authority attaches the phrase to the hue or aspect of the bird, and, when so attached, it loses all definite idea of colour. . . . Evidently enough, Homer's idea in this matter could not but be most vague and dim."

I have quoted these passages in order to show what a remarkably apposite commentary they offer on my own words, written twenty years ago.

"Green is a colour most perplexing to the patient, who cannot be said to manifest any definite sensation about it at all." It would scarcely be possible to give a more appropriate description than Mr. Gladstone has given of the impressions of the colour-blind in regard to green, although in all probability he knew little or nothing of these when he wrote the passages in question.

I have already explained how this arises, theoretically, from the invisibility of green proper to the colour-blind, and the appearance of green objects to them under false colours. As a matter of practice I have felt, throughout my life, that this colour has been my greatest stumbling-block, in regard to which my ideas and expressions have gone most astray.

In order to guess how a colour-blind person would be likely to use the term, we must bear in mind the fact, already stated, that the majority of greens in nature appear to him as varieties of yellow; chlorine gas, for example, which takes its name from the Greek word, is a decided yellow to me. And further, it is a fact within my own experience that, unless very powerfully coloured, such yellow greens have mostly a pale, washed-out appearance; indeed, if I find that a new object presents to my eye a sickly pale tint of yellow, I often make a successful chance shot in calling it green.

Keeping these explanations in mind, Homer's applications of the word appear quite natural.

The idea of paleness I have, I think, sufficiently explained. A pale face appears to me just such a sickly yellow as I have described.

I do not exactly know what the "fresh twigs" pulled by Eumæus to make a bed for Ulysses would be like, but they would probably be either green or brown, both which present to the colour-blind shades of yellow.

Honey, a pale yellow, is a perfect match to my eye with varieties of yellow green.

The club of the cyclops would be the colour of the bark of the olive tree, which is, I believe, a brownish grey, and would still be in the dark yellow category to the colour-blind.

The application of the term to the nightingale will naturally puzzle the normal-eyed, as the bird has nothing green about him. But he is described (N. 381) as a compound of tawny, olive, brown, and ash colour; and all these, except the last, which I do not quite understand, convey to the colour-blind the impression of modified yellow, by which chiefly they know green.

Οἶνοψ.

Wine-coloured. Homer (N. 377, H. 472), in speaking of wine, uses (omitting *aithops*, which, Mr. Gladstone thinks, may refer more to sparkling than to colour) two epithets: *eruthros*, red; and *melas*, black. This is con-

sistent enough with ordinary usage, as the red wine in the south of Europe often is very dark, and is called *vino nero*.

To the colour-blind, if red wine is moderately coloured it appears a dark yellow-brown, but when very dark the yellow element may disappear, being overpowered by the blue in the purple, when the impression is simply black, as to the normal-eyed. I frequently see strong red wines in which I can distinguish no colour at all.

Homer uses the word *oinops* for oxen, which, if a dark ruddy brown, would present to the colour-blind the same hue as red wine.

He also uses it for the sea, under special associations which seem to indicate darkness, as, for example, "under a rattling breeze at night." In such a case the sea would show no colour, and the term might be merely a poetical simile drawn from the *vino nero*.

We now come to the opposite group of colour-epithets, applied to objects which give to the colour-blind a sensation of blue; this group, in accordance with the comparative rarity of the impression it denotes, comprehends a less variety of words, being limited to two.

The most important is

Πορφύρεος,

which, I suppose, may be translated purple.

This word, with its compounds, has, Mr. Gladstone says, the largest and most varied application in Homer; he considers its use peculiarly embarrassing, and dwells (N. 373-4, H. 461) at considerable length on the anomalies it presents.

He states that Homer's uses of the word imply three very different forms of colour, namely, red, purple, and grey, and no doubt, to the normal-eyed, these are incongruous enough; but, when we consider the terms under the colour-blind aspect, the incongruities disappear.

The second colour appreciable to the dichromic vision is blue, and a great number of different hues in nature, which happen to contain blue in their composition, appear to the colour-blind as varieties or shades of this colour. For example, many crimson hues of red, verging towards violet, contain blue, and, being darkened by the red, show dark shades of this colour. Purple or violet is a still bluer compound. All blue-greens appear blue, and, in regard to dark greys, they often have blue in them, or at least give a blue impression.

Now assuming the poet to have dichromic vision, I suppose *porphureos* would be the most likely word in Mr. Gladstone's list to represent his idea of the various shades of blue; and it is easy to recognise its applications in this way by the examples given (N. 373, H. 461). Omitting the metaphorical uses of the word, we find it applied:—

To various articles of clothing and furniture, which might be of many colours, all conveying the sensation of blue.

To the rainbow. I have, in my paper, fully explained the appearance of the solar spectrum; it presents two colours only, the less refrangible part appearing yellow, the more refrangible part appearing blue. Hence a colour-blind person in speaking of the rainbow may correctly use either term. Homer appears to use both, for in another place he compares the rainbow to a dragon or a serpent, for which he uses the words *daphnoios* or *kuaneos*, both, as we have seen, belonging to the yellow category.

To blood. Under the word *eruthros* it has been pointed out that blood, when venous, loses what yellow element it possessed and by tending towards purple shows a blue impression to the colour-blind. This will account for the mention of blood in this class.

To a dark cloud. The prevailing hue of dark clouds is, both to the normal-eyed and the colour-blind, grey.

But this grey may, by atmospheric causes, become tinged either with brown or with blue; the former case has been noticed under the word *kuaneos*, the latter comes in here.

To waves and to the darkening sea. The beautiful blue colour often seen in the Mediterranean is notorious, and to me, at least, it has been particularly marked in the darker aspects of the water.

To death. So far as this application of the colour epithet may be literal, it may be explained by the fact that the livid hue of a corpse has to the colour-blind a decidedly blue tinge.

Ἰοειδής.

Violet-coloured. This epithet clearly belongs to the blue group, for the colour violet is a compound of blue with red, and to the colour-blind eye the blue element alone is visible, the red addition having merely the effect of giving a dark shade. Hence the word may be used by them consistently enough for all impressions of darkened blue.

It is applied by Homer:—

To the sea, for which, on the colour-blind view, it is equally appropriate with *porphureos*.

To iron, which is both to the normal-eyed and to the colour-blind a bluish grey.

To wool, which Mr. Gladstone (N. 380) thinks may have been dyed to a deep purple.

To living sheep (H. 471). This application is not so intelligible, as, so far as I recollect the appearance of black sheep, their colour has inclined rather to brown than to blue. The word, however, used here is a compound one, *iodnephes*, meaning, according to Liddell and Scott, "violet-dark," and it may possibly refer to that variety of dark violet I have before mentioned, in which the blue tinge is indistinguishable. There would seem to be a certain analogy here with the use of *oinops* for the black sea.

Mr. Gladstone includes among his adjectives one which I call neutral, *i.e.*, used for objects which do not convey to the colour-blind either of their two colour sensations. This is

Πολιός,

usually translated grey or hoary. Mr. Gladstone says (N. 381, H. 466) it is applied to the human hair in old age, to iron, and to the hide of a wolf, in all which cases grey is a fair interpretation.

But it is also a stock adjective for the sea, being used for it in no less than twenty-four places. Now the standard colour of the sea (the blue being exceptional) is, I am told, green, and I know by my own observation that the particular hue of green is just that which is neutral to the colour-blind, thus appearing grey. It is possible that the word, in the sense of "hoary," may refer to the sea foam; but if it is really intended to mean grey, its repeated use for the green sea is an additional proof of the correspondence of the sensations of the writer with those of the colour-blind.

I pass over the words *aithos*, *aithops*, &c., as Mr. Gladstone, while finding great difficulty in their interpretation, hardly considers them epithets of colour.

It may be useful to add a summary, appreciable at a glance, of the various objects to which colour epithets have been applied by Homer, classifying them as above described.

GROUP I.—Objects conveying to the Colour-blind the Sensation of Yellow or Yellow Darkened.

ἄνθρωπος—	Human hair.
	Coats of horses.
ἔρυνθος—	Copper.
	Wine, Nectar.
	Blood (arterial).

Φοινῖξ—	Blood (arterial). Coat of a horse. The dragon or serpent. The rainbow. The jackal. The lion. Cloaks or mantles. Red prows of ships. The palm tree.
Ῥοδόεις—	The rose. Olive oil.
Κυάνεος—	Bronze. Dark eyebrows and hair. A dark cloud. The dark coat of a horse. Masses of armed men. Black mourning garments. Sea sand. The sea beating on rocks. Red prows of ships. The dragon or serpent.
Χλωρός—	A pale face. Fresh pulled twigs. Honey. Olive wood bark. The nightingale.
Οἶνοψ—	Red wine. Oxen. [The sea in circumstances of darkness.]

GROUP II.—*Objects conveying to the Colour-blind the Sensation of Blue, or Blue Darkened.*

Πορφύρεος—	Various articles of clothing and furniture. The rainbow. Blood (venous). A dark cloud. Waves and the darkening sea. Death.
Ἰοειδής—	The violet. The sea. Iron. Dark dyed wool. [Dark living sheep].

EXTRA GROUP.—*Objects conveying to the Colour-blind a Neutral Sensation.*

Πολίως—	Human hair in old age. Iron. The hide of a wolf. The sea.
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I think the following propositions may be now taken as made out on the evidence supplied by Mr. Gladstone:—

1. That Homer's applications of colour epithets are in many cases inconsistent with the normal ideas in regard to them. This is the first and most general symptom of colour-blindness.

2. That this inconsistency is particularly noticeable in the use of the expressions for red and green. This is a further and more definite symptom, showing the peculiarly defective sensations in regard to these particular colours.

3. But that when the objects referred to are classified in two groups, according to the two colour sensations they respectively offer to the colour-blind eye, the use of the colour-epithets becomes consistent, no epithet belonging to one group being used (except in one doubtful case) for an object belonging to the other. This is a still more definite symptom, pointing, as it seems to me, to the *dichromic* nature of the malady.

It is not my province to carry the matter further; but if the explanation offered be correct, it may involve some very interesting considerations.

One may ask whether the defect in vision which gave rise to these singular uses of the colour epithets was likely to have been general among the people of the time? Do the expressions convey what would have been the general sense of the Greeks of the Homeric age? If so, we may fully concur in Mr. Gladstone's hypothesis, that the organ of colour was but partially developed among them, while at the same time we learn exactly what was the nature of their deficiency. It would be a most interesting fact in physiology and optics if we could show, in this way, that dichromatism was an early stage of human vision, out of which the present more comprehensive and perfect faculty has been gradually developed in the course of some thousands of years.

But on the other hand, it is quite possible that this defect was not general, that it existed only in the person or the writer whose language exhibits it. If this view is correct it may have a most important bearing on a dispute that has long agitated the scholarly world, namely, as to the authorship of the Homeric Poems.

If we can trace, running through the whole of these immortal works, the distinct and consistent evidence of a well-marked personal peculiarity in the writer—a positive characteristic by which his individual identity may be, in all parts, clearly inferred—we have the strongest possible proof, by internal evidence, of the existence of a single author, to whom the whole of the poems are due.

WILLIAM POLE

NOTES

AMONG the well-deserved decorations awarded in connection with the Paris Exhibition is that of Grand Officer of the Legion of Honour to the eminent chemist M. Pasteur.

At the annual meeting of the Mathematical Society, November 14, Lord Rayleigh, F.R.S., instead of giving an address, will read a paper on the Instability of Jets.

IN connection with the operations of the United States Fish Commission during the past summer, *Harper's Weekly* furnishes some particulars of what may be considered as one of the most important discoveries of recent date in regard to the geology of North America. During the operations of the Commission a formation was met with which belongs probably to the miocene or later tertiary, as shown by the occurrence of numerous fragments of eroded, hard, compact, calcareous sandstone and sandy limestone. These are usually perforated by the burrows of *Saxicava rugosa*, and contain in more or less abundance fossil shells and fragments of lignite, radiates, &c. These fragments have generally been hauled up by trawl lines from depths of from 50 to 250 fathoms, and have already furnished a large number of species, some of them northern forms still living on the New England coast, others for the most part extinct. A conspicuous fossil of an undescribed species belongs to the genus *Isocardia*. Other genera are *Mya*, *Ensatella*, *Cyprina*, *Natica*, *Cardium*, *Cyclocardia*, *Fusus*, *Latirus*, *Turritella*, &c. The specimens so far obtained range from George's Bank to Banquereau, a region of at least several hundred miles in length, and extending along the outer banks from off Newfoundland nearly to Cape Cod. Indeed, it is suggested by Prof. Verrill that the formation constitutes in large part the plateaus known as fishing banks, frequented by such large numbers of cod, halibut, &c. The credit of bringing these specimens to light is due chiefly to Mr. Warren Upham, who originally visited Gloucester for the purpose of investigating certain glacial drift and fossiliferous deposits, and who obtained many of the specimens from fishermen who had brought them in and kept them as curiosities.

IN the summer of 1877 an expedition in the interest of the Princeton (U.S.) College Museum of Geology and Archaeology was fitted out for the purpose of making explorations in